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Introduction: Models of planetesimal formation are complicated and generally non-predictive, but can play a valuable role for meteoritics in setting context, assessing plausibility, and suggesting valuable new observations. Some models actually do lend themselves to observational tests. The chondrite and asteroid data is assessed for the most fundamental constraints it currently provides, and suggestions are made for critical future studies.

Nebula Evolution; turbulence: At the root of it all is the environment in which meteorite constituents evolve before and while becoming parts of a planetesimal. There are many observations of protoplanetary disks and ALMA will revolutionize the field, but the asteroid/terrestrial planet regions of greatest interest to meteoritics are still very hard to resolve. The intensity of nebula turbulence is critical to every stage of planetesimal formation, with recent and ongoing insights that will be debated for years [1]. Nebulae evolve substantially in the timeframe known to cover meteorite formation, with implications for observations.

Incremental growth by sticking: Particle growth must *start* by sticking, but *proceeding* to planetesimal size this way remains problematic because of "bouncing" and fragmentation. The very different sticking properties of water ice and silicates can significantly affect evolution in the inner solar system, because as particles grow, they drift radially inwards [2]. In the meteorite parent body formation region, the solids mass density and gas redox conditions can vary dramatically with location and time during the first 0.1-1 Myr of nebula evolution, as icy and carbonaceous material drifts in and evaporates [2]. Particle opacity changes with size, controlling nebula temperature and structure [2]. The concept of a static "minimum mass solar nebula of cosmic abundance" is perhaps now more of a hindrance than a guideline.

Leapfrog Accretion: The various "barriers" to incremental growth, including not only the traditional "meter-size" barrier but newly recognized "km-size" barriers as well, have sparked interest in scenarios capable of bypassing these barriers, proceeding directly from nebula particles of various sizes to planetesimals [3]. The prospects for these scenarios will be discussed in light of chondrite parent body structure and composition, and the diversity of chondrule ages within single chondrites.

Future meteoritic observations: The chondrule size, and the composition (chemical and isotopic) of chondrites, as a function of metamorphic grade, combined with thermal models, can constrain the homogeneity and size of primary (pre-heating) planetesimals. Size-density distributions of particles in "primary texture" are needed to obtain better evidence for or against aerodynamic sorting. Detailed studies of pristine, fine-grained "accretion" rims may tell us as much about the life history of nebula particles as the chondrules themselves. High-precision measurements of variance in formation ages of different chondrules within specific chondrites will provide a critical handle on assessing leapfrog accretion models. Radiometric-age assessment of O-isotopic evolution provides additional constraints on nebula evolution. Achondrites probably represent the earliest planetesimals but are hard to interpret without good thermal models. Primitive "chimeric" chondrites, with properties intermediate to familiar types, may constrain radial/temporal mixing.

References: [1] Turner, N. et al. 2014, chapter in *Protostars and Planets VI;* in press [2] Estrada, P., J. Cuzzi, and D. Morgan 2015; Astrophys. J, submitted; [3] Johansen A. et al 2015, chapter in *Asteroids IV;* in press; arXiv:1505.02941v1